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γ -ray-pulse formation in a vibrating recoilless resonant absorber

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Abstract

© 2015 American Physical Society. ©2015 American Physical Society. We study propagation of γ radiation from a Mössbauer radioactive source through a vibrating recoilless resonant absorber and find the optimal conditions to produce a periodic train of γ-ray pulses with maximum peak intensity, several times higher than the intensity from the source, and minimum duration, much shorter than the lifetime of the emitting nuclear state of the source. The shape, duration, and repetition rate of the pulses are tunable in a wide range. We propose modifications of the recently reported experiment [F. Vagizov, Nature (London) 508, 80 (2014)10.1038/nature13018] to produce pulses with higher peak intensity and shorter duration using absorbers enriched by the resonant nuclei and discuss possible applications of the generated pulses for the time-domain Mössbauer spectroscopy.

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